

Opinion  
Infectious Diseases,  
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# Epidemiologic Evaluation and Risk Communication Regarding the Recent Reports of Sudden Death after Influenza Vaccination in the COVID-19 Pandemic

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To prevent the twin-demic, where the COVID-19 pandemic and the 2020-21 influenza epidemic overlap, Korea started a national influenza vaccination program on September 25, 2020. Although the program has been conducted annually, protocol violations during the vaccine transport have been reported this year which led to public anxiety and the Korea Centers for Disease Control and Prevention (KCDC) decided to stop vaccination for 2 weeks.<sup>1</sup> During the period, the KCDC reviewed and investigated the quality and safety of the vaccines. Recently, multiple cases of death after vaccination are being reported through mass media, which brought about chaos in the field and public doubts on the safety of vaccination. Distrust in the national vaccine program can cause a fundamental problem in public health, and concerns are growing as it can lead to campaigns against vaccines as in the United States and Europe.

On October 22, 2020, the media reported a total of 28 deaths after vaccinations.<sup>2</sup> At present, 12 vaccines (2 imported, 10 domestic products) are supplied for the national vaccine program,<sup>3</sup> but the deaths are not limited to any specific product and geographic localities.

However, haste suggestion of an association between those deaths and vaccination has a logical pitfall. The real concern of the public is potential death resulting from the side effects of the vaccine, but what we are observing so far is mere that the deceased people were vaccinated shortly before death. This is a typical example of a conditional probability, which does not imply any association or causation by itself.

This is proved by simple reasoning. About 300,000 deaths occur annually in Korea, and the average daily death toll rises slightly during winter. Thus, it can be estimated that there will be about 1,000 deaths every day around October. Assuming that the national influenza vaccination rate is about 50% and the vaccination period is about 2 months, about 1% of the total population will be vaccinated every day during the vaccination period. Without consideration of age and sex, as much as 1% of 1,000 deaths per day in October (about 10 deaths) would occur as deaths within a day since vaccination. Because about 10% of the causes of death in Korea are unknown, the cause of death in 10% among the 10 post-vaccination deaths every day will be unknown. In other words, it can be seen that death after vaccination at the currently reported frequency is not unusual, even with a simple estimation.

What makes this problem more complicated is a recall bias. Recall bias is one of the most important problems in epidemiological studies, and it refers to the phenomenon of reinforcing

memories and statements about moral reproof or memorable prior events when certain events occur. Vaccination by itself can be the subject of recall bias, as it might be perceived as a significant event for a person who has been healthy and had no recent unusual events.

On October 21, 2020, the KCDC announced the results of a preliminary epidemiological investigation. Let's look at the possible side effect scenarios based on the report.

### **1) Problems in the Vaccine Manufacturing Process**

If there had been a problem with vaccine manufacturing, the vaccine doses causing deaths must be produced by a single company or share the same lot number. However, according to the current investigation, the manufacturers and lot numbers of the implicated vaccines were different. This strongly suggests that it is unlikely to be a problem in the manufacturing process. Two pairs of the 28 reported deaths after vaccination were found to have the same lot number. But this is also a simple scientific common sense. This problem, called the birthday paradox, is a concise calculation of the probability of two people with the same birthday when people come together randomly. Even if only 23 people gather, the probability of having the same birthday is 50%. The number of vaccine's lots in use in Korea is about 200. Therefore, even if two pairs of the same lot number occur, it can be reasonably explained.

### **2) Improper Vaccine Transport Process or Broken Cold Chain**

If there had been any deterioration or damage of vaccines during the transport process, a regional pattern should appear. Vaccine delivery is carried out through refrigerated vehicles by region, so local clustering is expected in death cases after vaccination. However, currently reported cases are located sporadically across the country. Therefore, problems in the transportation process are unlikely.

### **3) Problems in Local Distribution and Storage of Vaccines in Medical Facilities**

In the process of distribution or storage of the vaccine on a small scale, problems such as refrigerator errors may occur. However, in that case, we could expect minor side effects or deaths that occur in the patients who were vaccinated in the same medical facilities. However, no additional adverse events have been reported in medical institutions where the deceased were vaccinated.

### **4) Side Effects of the Vaccine Itself**

Typical side effects of vaccines include anaphylaxis and Guillain-Barre syndrome. However, anaphylaxis occurs very shortly after vaccination. The intervals between vaccination and death in the currently reported cases are too long to support the possibility of anaphylaxis. Guillain-Barré syndrome is one of the most serious side effects that can occur after vaccination. However, since muscle weakness develops over a period of half a day to several weeks, the progression of symptoms are usually observed. Current cases appear to be sudden deaths and there are no reports of such progressive episodes.

Therefore, it is reasonable to infer that the causal relationship between vaccination and death is unlikely based on the epidemiological findings alone. In addition, this conclusion is supported by the fact that no cases suspected of such side effects have been reported in infants and toddlers who receive influenza vaccination as much as the elderly.

According to a 2013 study using the US's Vaccine Safety Datalink (VSD),<sup>4</sup> the mortality rate within a week after vaccination reached about 6 per 100,000 vaccinations. In particular, the

mortality among vaccinees aged 65–74 years and 75–84 years were 11.3 and 23.2 per 100,000, respectively. These results indicate that unrelated deaths after vaccination are always expected at a certain level. And as the crude mortality rate of the elderly is already very high, the currently observed incidence does not seem unusual even if we assume that the current report of death after vaccination in Korea is close to total surveillance.

Vaccines have been established as one of the best countermeasures against infectious diseases for a long time. Although there had been some serious side effects in the past, many studies and clinical trials have proven that the vaccine is very safe with the modern vaccine manufacturing process and the cold chain.

Of course, a close investigation must be followed; however, serious side effects of influenza vaccines, especially deaths, are extremely rare. It is hard to imagine a plausible theoretical mechanism that could explain the influenza vaccine causing deaths in the way that is reported.

Concerns over the deaths after influenza vaccination stem from distrust in the vaccine distribution and transportation process, but the COVID-19 pandemic and excessive media attention are making the situation extreme. Clinicians, administrators, and scientists must cope wisely with the current crisis by delivering sound scientific information to the public. Also, risk communication should be made to build confidence in future vaccination for severe acute respiratory syndrome coronavirus-2.

\*Full text in Korean is attached as a supplementary material (**Supplementary Data 1**).

## SUPPLEMENTARY MATERIAL

### Supplementary Data 1

[Click here to view](#)

## REFERENCES

1. [https://www.youtube.com/watch?v=Qsq\\_ZMn1UVg&t=196s](https://www.youtube.com/watch?v=Qsq_ZMn1UVg&t=196s). Updated 2020. Accessed October 23, 2020.
2. [https://www.chosun.com/national/national\\_general/2020/10/22/QOG5IW6KSNCS7CHKECOZY2TTNY/](https://www.chosun.com/national/national_general/2020/10/22/QOG5IW6KSNCS7CHKECOZY2TTNY/). Updated 2020. Accessed October 23, 2020.
3. <https://m.blog.naver.com/ksb983192/222086648626>. Updated 2020. Accessed October 22, 2020.
4. McCarthy NL, Weintraub E, Vellozzi C, Duffy J, Gee J, Donahue JG, et al. Mortality rates and cause-of-death patterns in a vaccinated population. *Am J Prev Med* 2013;45(1):91-7.  
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